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## THE NAIADES OF MISSOURI.


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(*Plates i—xxviii.*) New Series.

### Introduction.

After some years of intensive studies in the field, library and laboratory an attempt is made to give a catalogued account of the *Naiades*, or Fresh-water Mussels, of Missouri. Most of the data for this descriptive and illustrated catalogue have been collected through extensive, personal surveys of the most important streams and lakes of the State and now the typical anatomical and shell material from the different localities are preserved in the writer's laboratory. No literature of any consequence, dealing with the *Naiades* of Missouri, had been produced until the author of this paper made a preliminary report on "The Mussel Resources of Missouri." This was, however, a government report, published for economic purposes, the detailed account of the scientific observations of which will not appear until a later date.

The plan of classification, based on anatomical structures, notably those of marsupial characters, has been carefully followed in this work. The many changes in the nomenclature of this catalogue from that of the Simpsonian system are due especially to the recognition of Lindahl's orthographic modification and of the wise scheme of taxonomy for the *Naiades* begun by Sterki (1906) and well consummated by Ortmann (1912); and also to the acceptance of Rafinesque's priority as recently revived by Mr. Frierson and accepted by Dr. Ortmann. The writer believes that the ultimate taxonomic system will be based far more upon the anatomical structure of juvenile and adult than upon their shell characters from the fact that the soft parts are more constant

morphologically and less liable to parallelism and convergence. We should not, however, lose cognizance of the importance concerning shell characters. External factors may so shape the shell, as to individualize it, but, under normal conditions, do not often destroy all traces of indentification with some group. Since validity is so dependent upon the examination of both hard and soft structures of large series of individuals, it is felt that the species, as recorded for their extensive and intensive studies herein, are fairly well settled within their genera. Fortunately extensive field work has made this intensive study possible. On one occasion the rare opportunity was given the author to make a mussel survey of three hundred miles down the Osage River in a row boat and ample time was given to the study of one of the richest faunae of Missouri. Two papers, "Mussel Studies Afield" for the years 1913 and 1914, are now in MS. recorded matter of which is submitted herewith. The ecologic facts secured in these field surveys are especially interesting. For example, in the long trip down the Osage, the largest tributary of the Missouri in the interior of this state, it was found that the flat or compressed forms found at the headwaters, where the water is shallower and swifter, become more swollen and heavier shells further down stream where the water is deeper and more sluggish. The most valuable data gathered from these field excursions are the ecologic as illustrated in Plates x—xiv. Much physiologic and morphologic information, however, has been obtained from these immediate studies in nature that could not be secured otherwise, since actual observation have been made of the animal carrying on the nutritive and reproductive functions there as well as observed through aquarium studies (See Plate ix). More accurate idea of the morphology (especially of soft parts as to color, form, etc.) is obtained while the specimens are fresh and uncontracted as examined afield.

While this catalogued account is rather synoptical as to the text of its animal and shell characters, yet it has been the effort to be more complete than those literary works of somewhat similar character that have devoted more space to the structures of the shell; hence, much description will be found to be completely given for the first time, notably those of *M. heros* (Say), *Q. quadrula* (Raf.) *P. Utterbackii* Frierson, *R. tuberculata* (Raf.), *U. tetralasma* (Say), *Las. suborbiculata* (Say), *Prop. capax* (Green),

*Eur.* (*M.*) *brevicula* (Call), *T. Curtisii* Frierson and Utterback, and *T. Lefevrei* Utterback. Aside from the morphological synopsis of the nutritive and reproductive parts and also of the external and internal features of the shell the physiological and ecological facts are especially dwelt upon in the miscellaneous remarks. Because of the value of beak sculpture and glochidial characters as bases for classification a special feature is respectively made of the studies of juveniles and glochidia. Likewise, for classificatory reasons, a Breeding Record has been kept for the most representative generic types, and, in many instances, more complete records have been made by other observers due to more detailed observations during the winter season. This Record and also the Zoögeographic account of the *Missouri Naiades* have been carefully kept in tabulated form, but, as these accounts have been reserved thus for other special papers, they will only appear here in extracts.

In this catalogue eighty species and twenty subspecies are listed. Doubtless this list will be supplemented, although the author has worked the State rather thoroughly in actual field investigations—especially Central and Northwest Missouri—and has examined all species catalogued except the following which have been reported by Missouri collectors:—*An. Bealii* (Lea). *Cy. Aberti lamarckiana* (Lea), *Pleu. plenum* (Lea), *Lamp. reeviana* (Lea) and *Lamp. Powellii* (Lea). According to a report from the material sent away for identification, this State can claim another species not yet on the list,—a new and undescribed *Lampsilis*, near to *Lamp. biangulata* (Lea), and will soon appear under the authorship of Mr. Frierson.

The author wishes to express his thanks to those who have assisted him in this work. Especially is he thankful to Dr. George Lefevre who assigned and directed this work and rendered it possible through his numerous kindnesses and suggestions. Much credit should also be given Dr. W. C. Curtis, the co-worker with Dr. Lefevre, in the University of Missouri, Department of Zoölogy, where the author gathered much of his data through the facilities of the laboratory, library and museum. Besides the invaluable instructions received from these two gentlemen, who have contributed so much to the Science of Fresh-water Mussels, it was the author's pleasure to receive many valuable hints in person from Dr. R. E. Scammon, author of "Kansas

Unionidae." For other personal help while attending the University thankful acknowledgements are due to Dr. R. L. Moodie, Messers. G. T. Kline and F. A. Simpson. Under the illustrations of the new species (Plates v and vi) credit is given Mr. Kline, the University Artist-technician, for his excellent drawings. Through the kindness of Mr. Sampson, author of the "Mollusca of Missouri" (Exclusive of the *Unionidae*), permission has been given to examine his collections of mussel shells and make use of his list for same in determining geographic distribution and in confirming the reports of other Missouri collectors. Mr. B. F. Bush, a well-known scientist, and resident of Courtney, Mo., has rendered invaluable aid in sending for study immense collections taken mostly from the Ozark region where the author has not been permitted to carry on such exhaustive field studies as in the northern part of the State. Material from Missouri, contributed to the author's collection by Messrs. C. C. Crouch of LaGrange, E. J. Palmer of Webb City and D. K. Gregor of Fulton, has been thankfully acknowledged. The writer is deeply indebted to old collectors and authors, who were former residents of this State, viz:—Messrs. C. T. Simpson, W. A. Marsh, Elwood Pleas and Dr. John H. Britts; also to those students of *Naiades* for the nearest surrounding States viz:—Dr. F. C. Baker of Illinois, Rev. W. E. Wheeler of Arkansas, Dr. D. H. Wolcott of Nebraska, Dr. Junius Henderson of Colorado, Prof. F. B. Isely of Oklahoma and Drs. R. E. Coker, Thaddeus Surber, A. D. Howard, Prof. H. Walton Clark of Iowa. The last four named students are of the personel of the U. S. Fisheries Biological Laboratory, located along the Mississippi at Fairport, Iowa, where the author has done some study and has had pleasant personal contact with these gentlemen who have contributed so much to the science of Fresh-water Mussels. Besides being under obligations to the above-named for their literary and conchological exchanges, as well as for their valued correspondence and actual personal assistance, special mention would also be made of Drs. A. E. Ortmann, V. Sterki, C. B. Wilson, W. H. Dall, Harold Hannibal and Messrs. B. H. Wright, Bryant Walker and L. S. Frierson. The author is most grateful to Dr. Ortmann as an authority concerning the soft parts, to Mr. Walker for his treatment of the shell parts and to Mr. Frierson for his general knowledge of *Naiades* as well as for his special information concerning the Southwest forms. Through

very pleasant and extensive correspondence with these last three named gentlemen many problems have been solved and all novelties and changes have passed through their censorship.

. . . . . .

In order to elucidate the references in the text made to the physiography and geography an excerpt of the geographic distribution and also a tabulated Account of the Mussel Faunae of Missouri are given here, although, when it is possible to secure the desired data, it is the intention of the author to give *a detailed account of the zoogeography of the Naiades of Missouri and adjacent territory in relation to the restoration of the ancient geographic conditions of Central Mississippi Valley.*

In this connection the hydrography of the State may also be given for the sake of clearness in the use of the text. The drainage to the Mississippi is mostly through the Missouri River which flows entirely across the State just above the central line, and because of the loess soil held in suspension, together with its shifting sand bars and mud beds, it forms "*a great faunal barrier.*" Hence we may account for such a distinct mussel fauna north of the Missouri (known as "Old Muddy") from that south of it. The depauperization of mussel life is remarkable as noted in this river, together with that of the Mississippi from the mouth of the Missouri to a point below the southern boundary line of the State. The chief river basins of North Missouri belonging directly to this faunal barrier are the Chariton, the Grand, the Platte, the Nodaway and other minor ones of the Northwest. A chain of lakes, formed by the changing of the Missouri River channel into "ox-bow cut-offs," are found mostly in the northwestern part of the State along the Missouri in its eastern and northern flood-plains. The largest river basins draining into the Missouri River from the south are the Osage, Gasconade and Black-water. The most important one which drains directly into the Mississippi from this State is the Meramec. The chief basins found on the south slope of the Ozarks are the White, Black and St. Francis Rivers which are drained into the Mississippi through Arkansas. South-west Missouri drains into the Mississippi River partly and directly through the Neosho.

The following is a Classified Account, (although apparently contrary to the geologic facts, yet self-explanatory), showing the distinct mussel-faunae of the State that coincide with the different

physiographic provinces because of their different ecological conditions, namely, the muddy, sluggish streams of the north, swift, clear-water streams in the south and the mediocre streams of the Central portion:—

*a*=Prairies; *b*=Mo. and Miss. R's (Proper); *c*=Ozark Uplift.

I.—NORTH MISSOURI=Primitive Mussel Fauna.
1.a—New Prairies, or Glacial Plains. (N. and N.W.Mo.)
1.b—Missouri-Mississippi Flood-plains=Mo. Lakes and Miss. R. (Proper) to mouth of Mo. R. (N. E. Mo.).
Mo. R. (Proper)=Depauperated Mussel Fauna.

II.—CENTRAL MISSOURI=Intergraded Mussel Fauna.
2.a—Old Prairies of W. Central Mo.
1.c—Ozark Border, or North Slope.

III.—SOUTH MISSOURI=Modern Mussel Fauna.
2.c—Ozark Plateau.
3.c—Ozark Center, or South Slope.
2.b—Miss. R. (Proper) below mouth of Mo. R. and Miss. Lowlands of S. E. Mo.=Depauperated Mussel Fauna.

The Species and Sub-Species, listed under the following general **Key to the Missouri Naiades,** are assigned to the different sub-physiographic provinces where they predominate by employing to the *extreme right after their names the lettered numbers* of the above Classified Account: e. g., **Amblema rariplicata** (Deshayes)—**1.a.,**—thus indicating the **New Prairies Fauna** where mostly found.

### General Key for Identification of the Missouri Naiades.

This key is for very general use, being based upon the essential reproductive and nutritive characters of the animal parts for the Families, Sub-Families and Generic Groups. These characters are indicated under the lettering in the Scheme below and the enumeration of all *Naiades* for Missouri is denoted both by the Roman and Arabic numerals. The geographic distribution of the Species and Sub-Species is indicated by the lettered numbers. The following Scheme of progressive classification is employed:—

A.—FAMILY I.
(A).—SUB-FAMILY (I).
a.—GENUS I.
(a.)—GENERIC GROUP AND SUB-GENUS (I).
1.—SPECIES.
(1).—SUB-SPECIES.

A.—Gills with no water-tubes, septa incomplete, obliquely arranged; gill-

diaphragm incompletely formed; supra-anal absent, branchial and anal openings suppressed with no tendency to a siphonal form; all four gills both respiratory and marsupial; post-ventral margin of mantle undifferentiated; glochida semi-circular, ventral margin with irregular dentations; tachytictic, or short period ("Summer") breeders.

FAMILY I. MARGARITANIDAE Ortmann.

a.—Gill septa oblique from base of gills, more vertically arranged and shorter ventrad.....Genus I. CUMBERLANDIA, Ortmann

1.—*C. monodonta* (Say)—(l. c).

B.—Gills always with water-tubes, septa complete and parallel with gill filaments; gill-diaphragm complete; branchial and anal openings usually tend toward a siphonal form; all four gills or only outer, or parts of outer, marsupial; glochida generally suboval, spadiform, celtiform, spined or spineless.....FAMILY II. UNIONIDAE, Swainson

(A).—Connection between anal and supra-anal openings short or absent; inner laminae of inner gills free from visceral mass; post-ventral margin of mantle not specialized; marsupial undifferentiated, not distended when gravid; glochidia suboval, spineless, tachytictic for the most part..... ..... Sub-Family (I), UNIONINAE, Ortmann

a.—All four gills marsupial.

(a)—Conglutinates club-shaped, pinkish, solid; beak sculpture concentric and slightly nodulated at base of post-umbonal ridge; disk unsculptured....Genus II. FUSCONAIA Simpson

2. *F. undata* (Barnes)—(1. b)
(1). *F. undata trigona* (Lea)—(1. c)
(2). *F. undata trigonoides* Frierson—(1. a)
3. *F. flava* (Raf.)—(3.c)
4. *F. hebetata* (Conrad)—(1. c)
5. *F. ebena* (Lea)—(1. b)

(b)—Conglutinates leaf-like, compressed, subsolid white; beak sculpture concentric, extending zigzag out on disk which is greatly sculptured.....Genus III AMBLEMA (Raf.)

6. *A. peruviana* (Lamarck)—(1. c)
7. *A. rariplicata* (Deshayes)—(1. a)
8. *A. perplicata* (Conrad)—(3. c)
(3). *A. perplicata Quintardi* (Cragin)—(1. c)
9. *A. (plicata) costata* (Raf.)—(1. a)

Genus IV. MAGNONAIAS Utterback.

10. *M. heros* (Say)—(1. a)

Genus V. QUADRULA (Raf.)

11. *Q. pustulosa* (Lea)—(1. b)
(4). *Q. pustulosa schoolcraftensis* (Lea)—(1. a)
(5). *Q. pustulosa asperata* (Lea)—(1. c)
12. *Q. quadrula* (Raf.)—(1. b)
(6). *Q. quadrula contraryensis* Utterback—(1. a)

13. *Q. nodulata* (Raf.)—(1. b)
14. *Q. fragosa* (Contrad)—(1. b)
15. *Q. aspera* (Lea)—(1. c)
16. *Q. nobilis* (Conrad)—(2. a)
17. *Q. verrucosa* (Raf.)—(1. c)
18. *Q. metanevra* (Raf.)—(1. c)
(7). *Q. metanevra Wardii* (Lea)—(1. b)
19. *Q. cylindrica* (Say)—(3. c)

b.—Only outer gills marsupial.

(a)—Supra-anal opening absent; beak sculpture zigzag; disk greatly sculptured.....Genus VI. ROTUNDARIA (Raf.)
20. *R. tuberculata* (Raf.)—(1. c)
21. *R. granifera*(Lea)—(1. b)

(b)—Supra-anal present but short; beak sculpture concentric but disappearing toward disk which is mostly unsculptured.
Genus VII. PLETHOBASUS (Simpson)
22. *P. cooperianus* (Lea)—(2. c)
23. *P. aesopus* (Green)—(1. b)

Genus VIII. PLEUROBEMA (Raf.)
24. *P. obliquum* (Lamarck)—(1. b)
(8). *P. obliquum plenum* (Lea)—(3. c)
(9). *P. obliquum pyramidatum* (Lea)—(1. c)
(10). *P. obliquum catillus* (Conrad)—(1. c)
(11). *P. obliquum coccineum* (Conrad)—(1. c)
25. *P. catillus* (Conrad)—(3. c)
26. *P. coccineum* (Conrad)—(3. c)
27. *P. missourense* (Marsh)—(3. c)
28. *P. Utterbackii* Frierson—(3. c)

Genus IX. ELLIPTIO (Raf.)
29. *E. nigra* (Raf.)—(2. c)
30. *E. dilatata* (Raf.)—(2. a)
(12). *E. dilatata subgibbosa* (Lea)—(3.c)
(13). *E. dilatata delicata* (Simpson)—(3. c)

Genus X. UNIONERUS (Conrad)
31. *U. tetralasma* (Say)—(1. a)
(14). *U. tetralasma comptodon* (Say)—(1. a)

(B).—Mantle connection between anal and supra-anal openings always present, very long and moderate; inner laminae of inner gills usually free from the visceral mass; marsupia occupying entire outer gills only, distended ventrad and with lateral water-tubes when gravid; post ventral margin of mantle not differentiated; glochidia subtriangular, or spadiform, spined; bradytictic or long period ("Winter") breeder .....Sub-Family II. ANODONTINAE Ortmann

a.—Inner laminae of inner gills free from visceral mass; beak sculpture coarse, double-looped.

(a)—Mantle connection between anal and supra-anal openings moderately long; hinge rather complete, shell sculptured and somewhat thick.....Genus XI. SYMPHYNOTA (Lea)

32. *S. complanata* (Barnes)—(1.a)
33. *S. costata* (Raf.)—(3. c)

Genus XII. ARCIDENS Simpson)

34. *A. confragosus* (Say)—(2. c)

(b)—Mantle connection between anal and supra-anal openings very long; hinge completely absent; disk smooth; shell thin.

Genus XII. LASTENA (Raf.)

35. *L. suborbiculata* (Say)—(1. b)
36. *L. ohiensis* (Raf.)—(1. b)

Genus XIV. ANODONTA (Lamarck)

37. *A grandis* (Say)—(1. b)
38. *A. dakotana* Frierson —(1. b)
39. *A. corpulenta* Cooper—(1. b)
40. *A. Danielsii* Lea—(1. a)
41. *A. Bealii* Lea—(1. 2c)

(c)—Mantle connection between anal and supra-anal openings moderately long; hinge almost absent; shell rather thin, disk unscupltured.....Genus XV. ANODONTOIDES (Simpson)

42. *A. ferussacianus* (Lea)—(1. b—)

b.—Inner laminae of inner gills with tendency to connect with visceral mass; mantle connection between anal and supra-anal openings moderate; beak sculpture, heavy, concentric.

(a)—Marsupium with simple ovisacs; hinge teeth rather well developed with cardinals sharp and prominent.

Genus XVI. ALASMIDONTA (Say)

43. *A. calceolus* (Lea)—(3. c)
44. *A. marginata* Say—(2. c)

(b)—Marsupium with transverse ovisacs; hinge rudimentary with cardinals rounded and suppressed..Genus VXII. STROPHITUS (Raf)

45. *S. edentulus* (Say)—(2. a)

(C)—Mantle connection between branchial and anal openings present, never very long; inner laminae of inner gills rarely ever entirely free from visceral mass; post-ventral margin of mantle usually highly differentiated with papillae, flaps, etc.; part of outer gills in most genera specialized as marsupia, which, when gravid, bulging beyond original edge of gills, ruptured at ventral edge of ovisacs for escape of larvae; glochidia semi-circular, (LAMPSILIS type), or axe-head shape (PROPTERA type), ventral margin rounded, rarely spined; bradytictic.

Sub-Family III. LAMPSILINAE Ortmann.

a.—Marsupium with subcylindrical ovisacs; post ventral margin of mantle smooth; shell sometimes with disk sculptured, sex dimorphism of shell not distinct.

(a)—Marsupium occupying almost entire outer gill, edges folded, ovisacs several, small, short....Genus XVIII. ELLIPSARIA (Raf.)

46. *E. clintonensis* (Simpson)—(3. c)

(b)—Marsupium occupying outer gill in a few, large, long ovisacs.

Genus XIX. OBLIQUARIA (Raf.)

47. *O. reflexa* (Raf.)—(1. c)

Genus XX. CYPROGENIA (Agassiz)

48. *C. Aberti* (Conrad)—(3. c)

(15). *C. Aberti lamarckiana* (Lea)—(3. c)

b.—Marsupium with compressed and dilated ovisacs; post ventral margin of mantle smooth to papillose; shell generally without disk sculpture, sex dimorphism usually very distinct.

(a)—Inner post-ventral edge of mantles without flap or papillae, but slightly lamellate and crenulated; glochidia elliptic and celtiform, when normal in shape either extremely large or small.

Genus XXI. OBOVARIA (Raf.)

Sub-Genus (I)—PSEUDOON (Simpson)

49. *O. (Pseudoon) ellipsis* (Lea)—(1. b)

Genus XXII. NEPHRONAIAS (Cross and Fisher)

50. *N. ligamentina* (Lamarck)—(1. b)

(16). *N. ligamentina gibba* (Simpson)—(1. c)

51. *N. ellipsiformis* (Conrad)—(1. c)

(17). *N. ellipsiformis venusta* (Lea)—(1. c)

52. *N. Pleasii* (Marsh)—(3. c)

53. *N. ozarkensis* (Call)—(3. c)

Genus XXIII. AMYGDALONAIAS (Cross and Fisher)

54. *A. donaciformis* (Lea)—(1. a)

55. *A. truncata* (Raf.)—(1. c)

Genus XXIV. PLAGIOLA (Raf.)

56. *P. securis* (Lea)—(1. b)

Genus XXV. LASMONOS (Raf.)

57. *L. fragilis* (Raf.)—(1. a)

58. *L. Simpsonii* (Ferriss)—(3. c)

59. *L. leptodon* (Raf.)

Genus XXVI. PROPTERA (Raf.)

60. P. *alata* (Say)—(1. a)

61. *P. purpurata* (Lamarack)—(3. c)

62. *P. laevissima* (Lea)—(1. a)

63. *P. capax* (Green)—(1. b)

(b)—Inner post-ventral edge of mantle differentiated with papillae and flaps; glochidia normal in shape, medium in size.

Genus XXVII. CARUNCULINA (Simpson)

64. *C. parva* (Barnes)—(1.b)

65. *C. texensis* (Lea)—(1. a)

66. *C. glans* (Lea)—(1. a)

Genus XXVIII. EURYNIA (Raf.)

Sub-Genus (II). MICROMYA (Agassiz)

67. *E. (Micromya) limosa* (Conrad)—(3. c)

68. *E. (Micromya) iris* (Lea)—(3. c)

69. *E. (Micromya) brevicula* (Call)—(3. c)

(18). *E. (Micromya) brevicula Brittsii* (Simpson)—(1. c)

Sub-Genus (III).) EURYNIA (*sens. strict.*)

70. *E. (Eurynia) subrostrata* (Say)—(1. a)

71. *E. (Eurynia) recta* (Lamarck)—(1. c)

Genus XXIX. LAMPSILIS (Raf.)
72. *L. anodontoides* (Lea)—(1. a)
73. *L. fallaciosa* (Smith)—(1. a)
74. *L. Higginsii* (Lea)—(1. b)
75. *L. Powellii* (Lea)—(3. c)
76. *L. luteola* (Lamarck)—(3. c)
(19). *L. luteola rosacea* (DeKay)—(3. c)
77. *L. reeviana* (Lea)—(3. c)
78. *L. ventricosa* (Barnes)—(3. c)
(20). *L. ventricosa satura* (Lea)—(3. c)
Genus XXX. TRUNCILLA (Raf.)
79. *T. Curtisi* Frierson and Utterback—(3. c)
80. *T. Lefevrei* Utterback—(3. c)

ENUMERATION OF MISSOURI NAIADES.

| | |
|---|---|
| FAMILIES | 2 |
| SUB-FAMILIES | 3 |
| GENERA | 30 |
| SUB-GENERA | 3 |
| SPECIES | 80 |
| SUB-SPECIES | 20 |
| TOTAL OF SPECIES AND SUB-SPECIES | 100 |

**Explanation of Figures.**—For the purpose of illustrating the characteristic structures of the animal a few text-figures have been inserted immediately under the different Sub-Families. All figures illustrating these characters are about life-size and, while they are drawn from actual specimens in gravid condition, yet the sketches are more or less diagrammatic in order to emphasize the essential features. The sketches of the glochidia (most of them *figured here for the first time*) are actual camera-lucida drawings by using lenses to magnify 87 diameters. In both sets of these inserted figures, as well as in some of the plates at the close of the text, the following meanings are given to the letters for the labels:—

A=anal opening;
AN=anterior end;
AV=antero-ventral margin;
B=branchial opening;
D=dorsal, or hinge line;
F=foot;
I=inner gill;
M=marsupium;
P=palp;
PO=posterior end;
S=supra-anal opening;
V=ventral margin.

**Explanation of Terms, Abbreviations, etc., used in the text, bibliography and check list.**—A few technical terms introduced

here are suggested for general use. Reference to the four sections of the shell or mantle edges, limited by the anterior, posterior, dorsal and ventral extremities, can be expressed adjectively and adverbially by the respective terms, "*antero-ventral*," "*antero-ventrad*," "*post-dorsad*," etc. (See Plates I—III). "*Spadiform*" (shape of a spade head) and "*celtiform*" (shape of a celt, or axe-head) are used as adjectives in describing glochidia. In a few shell measurements adoption has been made of Scammon's term, "*umboidal ratio*," (um ra.) which is secured by dropping a line perpendicularly from the tips of the beaks to the longitudinal axis and expressing the distance from the intersection of the two lines to the anterior margin of the shell as a decimal fraction of the entire length of the longitudinal axis. The term, "*inter-dentum*," is used here for the bridge between the lateral and cardinal teeth. The terms, "*bradytictic*" and "*tachytictic*," as suggested by Ortmann, are adopted as meaning respectively, "long period" and "short period" breeders. The term "*diaphragm*," is also used here for the partition between the branchial and anal openings formed by the gills.

All shell measurements are reckoned in terms of millimeters (mm.) and length, height and diameter are considered consecutively. "*Diameter*" is the distance between the greatest convexities of closed valves. All other usages employed in this work have been in such common adoption as to need no explanation.

To make plain those parts of this catalogue,—especially the Synonomy and Bibliography,—the equalities for the abbreviations are given as follows:—

Am. J. Conch.—American Journal of Conchology.
Am. Jl. Sci. and Arts.—American Journal of Science and Arts.
Am. Nat.—American Naturalist.
An. Car. Mus.—Annals of the Carnegie Museum.
Biol. Bull.—Biological Bulletin.
Bull. Wash. Coll.—Bulletin of Washburn College.
Bull. U. S. Mus.—Bulletin of the United States Museum.
Bull. U. S. B. F.—Bulletin of the Unites Stated Bureau of Fisheries.
Jl. (or Jour.) Ac .N. Sci. Phila.—Journal of the Academy of Natural Science of Philadelphia.
J. Cinn. N. Hist. Soc.—Journal of the Cincinnati Historical Society.
Jl. Phila. A. Sci.—Journal of the Philosophical Academy of Science.
Mal. Soc. Lon.—Malacological Society of London.
Moll. Chicago, Pt. I.—Mollusks of Chicago, Part I.
Monog. Biv. Ohio.—Monograph of the Bivalves of Ohio.

Naut.—Nautilus.
N. Harm. Diss.—New Harmony Disseminator.
Pr. (or Proc.) Ac. N. Sci. Phil.—Proceedings of the Academy of Natural Science, Philadelphia.
Pr. Am. Phil. Soc.—Proceedings of the American Philosophical Society.
Pr. Mich. Ac. Sci.—Proceedings of the Michigan Academy of Science.
Pr. Ohio Ac. Sci.—Proceedings of the Ohio Academy of Science.
Pr. U. S. Nat. Mus.—Proceedings of the United States National Museum.
Tr. (or Trans.) Ac. Sci. St. Louis.—Transactions of the Academy of Science of St. Louis.
Tr. Am. Fish. Soc.—Transactions of the American Fish Society.
Tr. Am. Phil. Soc.—Transactions of the American Philosophical Society.
U. S. B. F. Ec. Cir.—United States Bureau of Fisheries, Economic Circular.
U. S. B. F. Doc.—United States Bureau of Fisheries Document.

(To be continued.)

## NOTES ON OUR LOCAL PLANTS.—XI.

BY J. A. NIEUWLAND.

Lake Maxinkuckee (clarke).

*BRASSICA* Cicero, Cato, Pliny XIX:8, XX:9.

*Brassica* Linn., Syst., (1735), Gen., 197 (1737), 299 (1754), Tour., Els., 188 (1694), I. R. H., 219 (1700) also V. Cordus, Brunfels, Lobelius, Tragus, Eric. Cordus, Matt., Lonicer, Gesner Tabernaemontanus, Castor Durante, Dodonaeus, Fuchs, Turner, etc., etc.

**Brassica Napus** Linn., Sp. Pl., (1753).

*Napus sylvestris* Bauhin, Pinax, 95 (1623), *Napus sativa* C. Bauhin, l. c.

Lake Maxinkuckee, (Clarke). Found escaped from cultivation, as also is *Brassica Rapa* and *Brassica oleracea.*

*CAKILE* Serapion, Semp., c. 65 (1531). Also *Cakile* Cusa, Camerarius, *Cakile* Linn., Syst., (1735), Gen., 196 (1737) 300 (1754), Tour., Els., (1694), I. w. H., 212 (1700), *Cakile* Miller, Gard. Dict., Abr., Ed. 4 (1754).

**Cakile edentula** (Bigel.) Hook., Fl. Bor. Am. I. 59 (1830).

*Bunias edentula* Bigelow, Fl. Bort., 157 (1814).

*Millers* (Umbach), Lake Co. (Deam). Laporte Co., (Deam) 211, 9062 Millers. Common only in the dune region of Lake Michigan near the shore line.